Calculating Reserve Risk Over a 1 Year Time Horizon

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Agenda

- Introduction
- Reserving Risk at t=0 (Ultimate Time Horizon)
- One-Year Time Horizon (t=1)
  - Process Algorithm
  - Residual Algorithm
  - Other Algorithms
  - Model Output
- Technical Provisions

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Technical Provisions

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Short-term (One Year) Reserving Risk

The "Parameterized Model" can be any stochastic model, so these concepts can be extended to other models!

ODP Bootstrap Model is illustrated in these graphs.

Many models simulate possible outcomes without "point estimates" as an intermediate step.

4   Bootstrap Model (Ultimate time horizon at time t=0)

Short-term (One Year) Reserving Risk

Many models are based on paid data only. Should also use incurred data to reflect information in case reserves.

Many models only use chain ladder methodology. Should also use Bornhuetter-Ferguson, Cape Cod, etc. methodologies.

5   Bootstrap Model (Ultimate time horizon at time t=0)

Short-term (One Year) Reserving Risk

Should also "weight" models and "shift" to reconcile with your deterministic "best estimate". Output is converted to distribution of paid cash flow (p_{1+}) reconciled to your ultimate "best estimate".

Finally, must aggregate LOB data into a consolidated corporate result, even though these graphs are for one LOB.

6   Bootstrap Model (Ultimate time horizon at time t=0)

Short-term (One Year) Reserving Risk

Bootstrap Model (Ultimate time horizon at time t=0)

Short-term (One Year) Reserving Risk

Mean = BE_0 = $E[p_{1+}]$

99.5%

Distribution of Possible Outcomes (p_{1+})

VaR_{1+}

Bootstrap Model (Ultimate time horizon at time t=0)

Short-term (One Year) Reserving Risk

BE_0 = Best Estimate at time 0 for an "ultimate" time horizon

BE_0 = avg. of incremental payments for all iterations (i.e., $E[p_{1+}]$)
(i.e., this is the "weighted-shifted" mean which matches the "best estimate")

Bootstrap Model (Ultimate time horizon at time t=0)

Short-term (One Year) Reserving Risk

Iterations can be split into parts, p_1 and p_{2+} (still at t=0)

Bootstrap Model (Ultimate time horizon at t=0), split into parts

Short-term (One Year) Reserving Risk

Bootstrap Model (Ultimate time horizon at t=0), split into parts

Short-term (One Year) Reserving Risk

Mean = BE_0^1 +   Mean = BE_0^{2+} =   Mean = BE_0

- Some level of correlation (independence)
  - i.e., "+" is not technically correct for graphs (mean is OK)
- Note, $BE_0^1 + BE_0^{2+} = BE_0$ and usually, $VaR_1 + VaR_{2+} > VaR_{1+}$*
- But, $VaR_1 < VaR_{1+}$ (perhaps significantly less)
- $BE_0^1 = E[p_1]$ and $BE_0^{2+} = E[p_{2+}]$

* Sub-additivity of VaR can be a problem, but should normally not be an issue.

Bootstrap Model (Ultimate time horizon at t=0), split into parts

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Short-term (One Year) Reserving Risk

One Year Risk starts with the first diagonal

13   Bootstrap Model, 1-Year Risk (Process Option)

Short-term (One Year) Reserving Risk

For each outcome at time 1, we can re-parameterize (again)

14   Bootstrap Model, 1-Year Risk (Process Option)

Short-term (One Year) Reserving Risk

And get conditional "point estimates" (i.e., BE_1^{2+}), given each possible outcome of the sample triangle and p_1

Then we can combine the "parts", p_1 and BE_1^{2+} .

15   Bootstrap Model, 1-Year Risk (Process Option)

Short-term (One Year) Reserving Risk

16   Bootstrap Model, 1-Year Risk (Process Option)

Short-term (One Year) Reserving Risk

This results in a combined distribution of the outcomes of p_1 and each associated "point estimate" BE_1^{2+} (i.e., they are correlated).

We can then compare this to the original distribution.

- In general, $E[p_1 + BE_1^{2+}] \neq BE_0$
  (In theory, they could be equal for symmetrical distributions)

17   Bootstrap Model, 1-Year Risk (Process Option)

Short-term (One Year) Reserving Risk

$VaR_{99.5}(p_1 + BE_1^{2+}) - BE_0$
$= VaR_{99.5}[p_1 + BE_1^{2+}] + (E[p_1 + BE_1^{2+}] - E[p_{1+}])$

18   Bootstrap Model, 1-Year Risk (Process Option)

Short-term (One Year) Reserving Risk

Simulation — Possible Outcomes (Sample Trapezoids)

Parameterized Model

Initial Data

1
2
N

Alternatively, most models will allow the "direct" simulation of the first diagonal (e.g., with Bootstrap sample residuals)

Assuming the possible outcomes are consistent, this will speed up the processing time

19 — Bootstrap Model, 1-Year Risk (Residual Option) — Milliman

Short-term (One Year) Reserving Risk

Simulation — Possible Outcomes (Sample Trapezoids) — Re-Parameterize Model — Point Estimates (BE_1^{2+})

Parameterized Model

Initial Data

1
2
N

The re-parameterized model still results in a "point estimate" for each iteration, which can be combined with the first diagonal.

Again, we can combine the "parts", p_1 and BE_1^{2+}.

20 — Bootstrap Model, 1-Year Risk (Residual Option) — Milliman

Short-term (One Year) Reserving Risk

Simulation — Possible Outcomes (Sample Trapezoids) — Re-Parameterize Model — Point Estimates (BE_1^{2+})

Parameterized Model

Initial Data

1
2
N

21 — Bootstrap Model, 1-Year Risk (Residual Option) — Milliman

Short-term (One Year) Reserving Risk

Mean = $E[p_1 + BE_1^{2+}]$

99.5%

Distribution of Possible Outcomes (p_1) + Point Estimates (BE_1^{2+})

This also results in a combined distribution of the outcomes of p_1 and each associated "point estimate" (i.e., they are correlated).

We can then compare this to the original distribution.

In general, $E[p_1 + BE_1^{2+}] \neq BE_0$

22 — Bootstrap Model, 1-Year Risk (Residual Option) — Milliman

Short-term (One Year) Reserving Risk

Mean = $E[p_1 + BE_1^{2+}]$

99.5%

Distribution of Possible Outcomes (p_1) + Point Estimates (BE_1^{2+})

Mean = $BE_0 = E[p_{1+}]$

Distribution of Possible Outcomes (p_{1+})

$VaR_{99.5}[(p_1 + BE_1^{2+}) - BE_0]$
$= VaR_{99.5}[p_1 + BE_1^{2+}] + (E[p_1 + BE_1^{2+}] - E[p_{1+}])$

23 — Bootstrap Model, 1-Year Risk (Residual Option) — Milliman

Short-term (One Year) Reserving Risk

Simulation — Possible Outcomes (Sample Trapezoids) — Parameter Risk Process Risk — Possible Outcomes (Future Outcomes ~ p_1) — Re-Parameterize Model — Possible Outcomes (Future Outcomes ~ $p_{2+}|p_1$)

Parameterized Model

Initial Data

1
2
N

Skewness in the data can affect the "point estimates"

A more robust solution is to simulate possible outcomes for each "sample trapezoid" given the outcome for that iteration $(p_{2+}|p_1)$

24 — Bootstrap Model, 1-Year Risk (Possible Outcomes Option) — Milliman

Short-term (One Year) Reserving Risk

The "nested" possible outcomes average to "expected values", or a more robust estimate of BE_1^{2+}.

After significantly more simulation (N^2), we can again combine the "parts", p_1 and BE_1^{2+}.

25   Bootstrap Model, 1-Year Risk (Possible Outcomes Option)

Short-term (One Year) Reserving Risk

26   Bootstrap Model, 1-Year Risk (Possible Outcomes Option)

Short-term (One Year) Reserving Risk

Mean = $E[p_1 + BE_1^{2+}]$

99.5%

Distribution of Possible Outcomes (p_1) + Expected Values (BE_1^{2+})

This results in a combined distribution of the outcomes of p_1 and each associated "expected value" (i.e., they are correlated).

Again, we can compare this to the original distribution.

- In general, $E[p_1 + BE_1^{2+}] \neq BE_0$ (Difference may be larger)

27   Bootstrap Model, 1-Year Risk (Possible Outcomes Option)

Short-term (One Year) Reserving Risk

Mean = $E[p_1 + BE_1^{2+}]$

99.5%

Distribution of Possible Outcomes (p_1) + Expected Values (BE_1^{2+})

Mean = $BE_0 = E[p_{1+}]$

Distribution of Possible Outcomes (p_{1+})

$$VaR_{99.5}[(p_1 + BE_1^{2+}) - BE_0]$$
$$= VaR_{99.5}[p_1 + BE_1^{2+}] + (E[p_1 + BE_1^{2+}] - E[p_{1+}])$$

28   Bootstrap Model, 1-Year Risk (Possible Outcomes Option)

Model Output

- Process and Residual Algorithms
- One-Year ➜ N Year or All
- Iteration parameters use "standard" results
- Insuring apples-to-apples comparison (audit trail)
  - N diagonals based on "standard" model (Process)
  - Correlation based on "standard" model
  - Shifting based on "standard" model
- New output tables

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Model Output

- Unpaid Claims (Ultimate Time Horizon)

Estimated Unpaid - Best Estimate (Weighted)									
Accident Yr	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2000	303	289	95.2%	-15	2,707	229	420	878	1,555
2001	533	455	85.3%	-439	4,048	445	742	1,325	2,451
2002	1,176	662	56.3%	-85	4,832	1,081	1,522	2,357	3,887
2003	3,205	1,039	32.4%	669	8,734	3,090	3,809	5,045	6,543
2004	8,377	1,670	19.9%	3,739	17,326	8,260	9,392	11,192	13,808
2005	22,071	3,101	14.0%	11,978	33,288	21,882	24,086	27,560	30,628
2006	58,464	5,573	9.5%	40,550	81,488	58,248	61,967	68,135	75,609
2007	138,876	11,194	8.1%	99,963	188,439	138,600	145,960	157,898	170,955
2008	306,604	42,458	13.8%	240,541	507,777	291,090	309,013	403,891	450,348
2009	553,041	92,394	16.7%	371,915	882,106	516,622	577,988	748,995	830,294
Total	1,092,650	103,408	9.5%	872,930	1,483,066	1,056,066	1,153,441	1,298,864	1,417,922

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Model Output

- Cash Flow (Ultimate Time Horizon)

Estimated Cash Flow - Best Estimate (Weighted)									
Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2010	475,957	41,818	8.8%	376,133	650,477	462,556	502,091	558,444	609,801
2011	301,346	30,115	10.0%	236,798	415,533	292,902	318,696	360,426	396,917
2012	169,656	19,062	11.2%	128,781	252,073	164,736	180,296	207,635	231,112
2013	85,067	10,451	12.3%	60,471	127,769	82,759	90,499	105,128	118,453
2014	37,126	5,814	15.7%	22,536	60,173	36,227	40,395	48,044	55,133
2015	13,671	2,457	18.0%	7,071	25,287	13,444	15,100	18,126	20,869
2016	5,906	1,497	25.3%	2,229	13,167	5,754	6,773	8,636	10,496
2017	2,204	884	40.1%	-10	6,683	2,133	2,735	3,772	4,906
2018	1,074	640	59.6%	-1,031	3,848	993	1,454	2,222	3,120
2019	644	400	62.1%	-230	2,841	564	861	1,403	2,054
Total	1,092,650	103,408	9.5%	872,930	1,483,066	1,056,066	1,153,441	1,298,864	1,417,922

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Model Output

- Unpaid Claim Runoff (Ultimate Time Horizon)

Estimated Unpaid Claim Runoff - Best Estimate (Weighted)									
Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2009	1,092,650	103,408	9.5%	872,930	1,483,066	1,056,066	1,153,441	1,298,864	1,417,922
2010	616,693	63,564	10.3%	477,558	857,970	596,302	652,788	744,243	815,996
2011	315,346	35,304	11.2%	229,034	444,548	305,634	335,361	385,670	425,292
2012	145,691	17,895	12.3%	98,871	215,088	142,031	155,200	180,545	202,205
2013	60,624	8,738	14.4%	38,400	92,369	59,378	65,757	77,385	87,146
2014	23,498	4,169	17.7%	11,497	39,380	23,156	26,024	30,946	36,020
2015	9,827	2,393	24.3%	3,310	19,323	9,669	11,286	14,109	16,628
2016	3,922	1,379	35.2%	-7	9,974	3,857	4,771	6,344	8,085
2017	1,718	790	46.0%	-529	5,088	1,635	2,185	3,129	4,228
2018	644	400	62.1%	-230	2,841	564	861	1,403	2,054

- Ultimate (t=0) unpaid distribution, less successive diagonals

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Model Output

- Unpaid Claim Runoff (Ultimate Time Horizon)

Estimated Unpaid Claim Runoff - Best Estimate (Weighted)								VaR	
Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	95.0%	99.5%		
2009	1,092,650	103,408	9.5%	872,930	1,483,066	1,298,864	1,417,922	325,272	100.0%
2010	616,693	63,564	10.3%	477,558	857,970	744,243	815,996	199,303	61.3%
2011	315,346	35,304	11.2%	229,034	444,548	385,670	425,292	109,945	33.8%
2012	145,691	17,895	12.3%	98,871	215,088	180,545	202,205	56,514	17.4%
2013	60,624	8,738	14.4%	38,400	92,369	77,385	87,146	26,522	8.2%
2014	23,498	4,169	17.7%	11,497	39,380	30,946	36,020	12,521	3.8%
2015	9,827	2,393	24.3%	3,310	19,323	14,109	16,628	6,800	2.1%
2016	3,922	1,379	35.2%	-7	9,974	6,344	8,085	4,163	1.3%
2017	1,718	790	46.0%	-529	5,088	3,129	4,228	2,509	0.8%
2018	644	400	62.1%	-230	2,841	1,403	2,054	1,410	0.4%

- Ultimate (t=0) unpaid distribution, less successive diagonals
- "Baseline" or proxy for CDR Runoff

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Model Output

- Unpaid Claims (1-Year Time Horizon)

Estimated Unpaid - Best Estimate, 1-Year Time Horizon, Process Algorithm (Weighted)									
Accident Yr	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2000	303	289	95.2%	-15	2,707	229	420	878	1,553
2001	533	503	94.3%	-557	5,294	433	747	1,342	3,078
2002	1,176	648	55.1%	-160	6,410	1,083	1,499	2,326	3,662
2003	3,205	1,017	31.7%	672	10,554	3,094	3,776	4,968	6,940
2004	8,377	1,567	18.7%	4,237	17,520	8,337	9,294	11,044	13,528
2005	22,071	2,948	13.4%	11,645	34,264	21,919	24,009	27,177	30,026
2006	58,464	4,986	8.5%	40,067	76,535	58,223	61,528	67,148	72,527
2007	138,876	10,741	7.7%	99,690	182,833	138,420	145,531	157,086	169,379
2008	306,604	34,652	11.3%	-1,002,417	418,774	305,671	315,112	345,685	387,609
2009	553,041	51,813	9.4%	403,504	933,469	542,255	562,102	660,179	737,297
Total	1,092,650	65,407	6.0%	-235,373	1,468,862	1,085,285	1,119,980	1,203,602	1,295,338

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Model Output

- Claim Development Result (1-Year Time Horizon)

Estimated Claim Development Result - Best Estimate, 1-Year Time Horizon, Process Algorithm (Weig)									
Accident Yr	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2000	0	289	0.0%	-318	2,404	-74	116	574	1,249
2001	0	503	0.0%	-1,090	4,761	-100	214	808	2,545
2002	0	648	0.0%	-1,336	5,234	-92	324	1,151	2,487
2003	0	1,017	0.0%	-2,532	7,349	-110	571	1,764	3,736
2004	0	1,567	0.0%	-4,140	9,142	-40	917	2,666	5,151
2005	0	2,948	0.0%	-10,426	12,193	-152	1,938	5,106	7,955
2006	0	4,986	0.0%	-18,397	18,071	-241	3,064	8,684	14,063
2007	0	10,741	0.0%	-39,186	43,958	-455	6,656	18,210	30,503
2008	0	34,652	0.0%	-1,309,020	112,170	-933	8,509	39,082	81,005
2009	0	51,813	0.0%	-149,538	380,428	-10,787	9,060	107,137	184,256
Total	0	65,407	0.0%	-1,328,022	376,212	-7,364	27,330	110,953	202,689

- The ultimate (t=0) mean is subtracted from every simulated value
- Shifted so CDR mean = ultimate mean

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Model Output

- Unpaid Claims (2-Year Time Horizon)

Estimated Unpaid - Best Estimate, 2-Year Time Horizon, Process Algorithm (Weighted)									
Accident Yr	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2000	303	289	95.2%	-15	2,707	229	420	878	1,553
2001	533	455	85.3%	-439	4,048	445	742	1,325	2,451
2002	1,176	639	54.4%	-101	4,817	1,093	1,509	2,336	3,845
2003	3,205	1,019	31.8%	905	8,667	3,111	3,803	5,000	6,586
2004	8,377	1,649	19.7%	3,747	16,394	8,264	9,384	11,101	13,887
2005	22,071	3,035	13.8%	11,976	32,974	21,908	24,042	27,307	30,219
2006	58,464	5,477	9.4%	41,274	78,688	58,193	61,857	67,920	74,941
2007	138,876	10,868	7.8%	98,970	184,213	138,369	145,604	157,589	170,168
2008	306,604	33,762	11.0%	241,898	500,619	296,270	310,956	385,770	428,663
2009	553,041	76,607	13.9%	382,827	962,437	526,314	571,429	717,569	797,965
Total	1,092,650	85,825	7.9%	880,772	1,487,434	1,067,001	1,140,315	1,266,247	1,369,324

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Model Output

- Claim Development Result (2-Year Time Horizon)

Estimated Claim Development Result - Best Estimate, 2-Year Time Horizon, Process Algorithm (Weig

Accident Yr	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2000	0	289	0.0%	-318	2,404	-74	116	574	1,245
2001	0	455	0.0%	-972	3,515	-88	209	792	1,917
2002	0	639	0.0%	-1,277	3,642	-82	334	1,161	2,669
2003	0	1,019	0.0%	-2,300	5,462	-94	598	1,795	3,381
2004	0	1,649	0.0%	-4,630	8,017	-113	1,007	2,724	5,510
2005	0	3,035	0.0%	-10,094	10,903	-163	1,971	5,237	8,148
2006	0	5,477	0.0%	-17,190	20,224	-271	3,393	9,456	16,477
2007	0	10,868	0.0%	-39,905	45,338	-507	6,728	18,714	31,292
2008	0	33,762	0.0%	-64,706	194,016	-10,334	4,353	79,172	122,060
2009	0	76,607	0.0%	-170,215	409,395	-26,727	18,387	164,528	244,924
Total	0	85,825	0.0%	-211,877	394,784	-25,649	47,666	173,597	276,675

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Model Output

- Claim Development Result Runoff

Estimated Claim Development Result Runoff - Best Estimate, 1-Year Time Horizon, Process Algorithm

Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2009	0	65,407	0.0%	-1,328,022	376,212	-7,364	27,330	110,953	202,689
2010	0	43,388	0.0%	-1,362,259	320,710	3,125	19,474	48,221	92,944
2011	1,389	23,215	1671.8%	-675,301	171,959	2,721	12,698	30,333	53,419
2012	2,452	11,813	481.9%	-289,217	89,790	2,837	8,763	18,986	29,995
2013	1,952	6,113	313.1%	-97,801	39,476	1,889	5,661	11,394	18,555
2014	981	3,622	369.1%	-42,728	18,884	848	3,181	7,068	11,126
2015	320	2,424	758.5%	-15,737	14,376	120	1,769	4,491	7,306
2016	70	1,591	2289.5%	-5,297	9,301	-107	940	2,911	5,440
2017	-61	974	-1607.5%	-4,022	6,490	-196	428	1,790	3,273
2018	-21	490	-2304.0%	-584	3,744	-154	185	917	2,152

- First row will match total CDR
- Sequential rows will remove cash flow diagonals
- For "All" option, each row is based on a different N

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Model Output

- Claim Development Result Runoff

Estimated Claim Development Result Runoff - Best Estimate, 2-Year Time Horizon, Process Algorithm

Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2009	0	85,825	0.0%	-211,877	394,784	-25,649	47,666	173,597	276,675
2010	0	47,177	0.0%	-121,714	339,282	-11,123	23,100	94,388	156,295
2011	0	21,767	0.0%	-62,275	296,245	-2,660	9,332	38,551	77,858
2012	2,042	11,584	567.3%	-30,759	150,548	962	7,881	22,160	43,901
2013	2,025	6,114	301.9%	-16,408	67,803	1,658	5,703	12,475	21,386
2014	1,364	3,458	253.5%	-8,494	31,386	1,292	3,579	7,130	11,319
2015	588	2,246	381.7%	-5,585	12,858	417	2,093	4,399	6,876
2016	184	1,416	769.4%	-3,670	7,074	77	1,065	2,660	4,394
2017	27	830	3098.2%	-2,141	4,586	-59	522	1,487	2,686
2018	-3	385	-12007.9%	-671	2,809	-77	198	685	1,554

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Model Output

- Claim Development Result Runoff

Estimated Claim Development Result Runoff - Best Estimate, All-Year Time Horizon, Process Algorithm

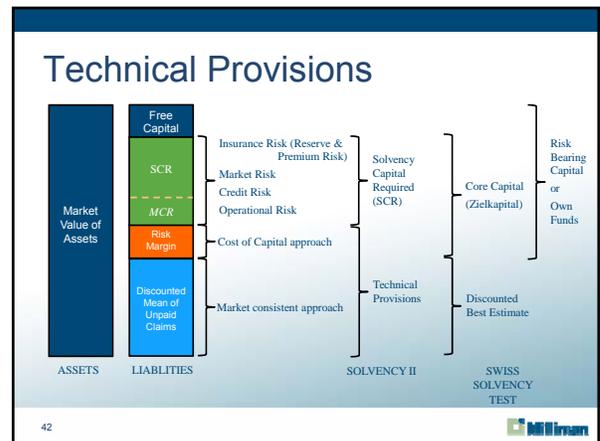| Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	50.0%	75.0%	95.0%	99.5%
2009	0	65,407	0.0%	-1,328,022	376,212	-7,364	27,330	110,953	202,689
2010	0	47,177	0.0%	-121,714	339,282	-11,123	23,100	94,388	156,295
2011	0	31,313	0.0%	-117,137	254,109	-7,428	14,591	62,074	103,168
2012	0	17,743	0.0%	-105,185	151,822	-3,885	9,135	35,166	55,738
2013	0	9,659	0.0%	-117,584	85,590	-1,530	5,210	17,560	28,663
2014	0	5,449	0.0%	-106,691	68,188	-364	2,666	8,446	15,005
2015	0	4,721	0.0%	-94,159	149,532	-177	1,557	4,920	9,465
2016	0	10,298	0.0%	-479,455	66,468	96	1,113	3,060	6,618
2017	0	5,773	0.0%	-275,477	20,432	15	611	1,779	4,001
2018	0	400	0.0%	-874	2,197	-80	216	759	1,410

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Model Output

- Claim Development Result Runoff

Estimated Claim Development Result Runoff - Best Estimate, All-Year Time Horizon, Process Algorithm

Calendar Period	Mean	Standard Error	Coefficient of Variation	Minimum	Maximum	75.0%	95.0%	99.5%	
2009	0	65,407	0.0%	-1,328,022	376,212	27,330	110,953	202,689	100.0%
2010	0	47,177	0.0%	-121,714	339,282	23,100	94,388	156,295	77.1%
2011	0	31,313	0.0%	-117,137	254,109	14,591	62,074	103,168	50.9%
2012	0	17,743	0.0%	-105,185	151,822	9,135	35,166	55,738	27.5%
2013	0	9,659	0.0%	-117,584	85,590	5,210	17,560	28,663	14.1%
2014	0	5,449	0.0%	-106,691	68,188	2,666	8,446	15,005	7.4%
2015	0	4,721	0.0%	-94,159	149,532	1,557	4,920	9,465	4.7%
2016	0	10,298	0.0%	-479,455	66,468	1,113	3,060	6,618	3.3%
2017	0	5,773	0.0%	-275,477	20,432	611	1,779	4,001	2.0%
2018	0	400	0.0%	-874	2,197	216	759	1,410	0.7%

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Technical Provisions

ASSETS — Market Value of Assets
LIABILITIES — Free Capital; SCR; MCR; Risk Margin; Discounted Mean of Unpaid Claims

Insurance Risk (Reserve & Premium Risk); Market Risk; Credit Risk; Operational Risk — Solvency Capital Required (SCR)
Cost of Capital approach; Market consistent approach — Technical Provisions

SOLVENCY II — Core Capital (Zielkapital); Discounted Best Estimate
SWISS SOLVENCY TEST — Risk Bearing Capital or Own Funds

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Technical Provisions

- Each possible outcome is discounted using a term rate structure
- Risk Margin is based on Cost of Capital for Runoff of CDR
- CDR also discounted using term rate structure

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Technical Provisions

Accident Year	Mean Estimate	Discounted Mean	99.5% VaR CDR	Discounted CDR
2000	303	302	59	59
2001	533	526	127	125
2002	1,176	1,152	249	244
2003	3,205	3,145	751	734
2004	8,377	8,209	1,909	1,866
2005	22,071	21,663	5,022	4,912
2006	58,464	57,302	13,540	13,229
2007	138,876	135,687	32,775	31,916
2008	306,604	298,272	49,072	47,915
2009	553,041	534,775	99,185	96,078
Total	1,092,650	1,061,032	202,689	197,078

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Technical Provisions

	Runoff Approximated Using Mean Estimate Runoff			
Calendar Year	CDR Runoff Percentage	CDR Runoff	Cost of Capital *	Discounted CoC
2009	100.0%	197,078	11,825	11,771
2010	61.3%	120,755	7,245	7,085
2011	33.8%	66,614	3,997	3,805
2012	17.4%	34,241	2,054	1,894
2013	8.2%	16,069	964	858
2014	3.8%	7,586	455	390
2015	2.1%	4,120	247	203
2016	1.3%	2,522	151	119
2017	0.8%	1,520	91	69
2018	0.4%	854	51	37
			27,082	26,231

Technical Provision = 1,087,263

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Technical Provisions

	Runoff Using CDR Runoff, Constant Discount			
Calendar Year	CDR Runoff Percentage	CDR Runoff	Cost of Capital *	Discounted CoC
2009	100.0%	197,078	11,825	11,771
2010	75.6%	148,934	8,936	8,739
2011	48.6%	95,730	5,744	5,468
2012	25.4%	50,124	3,007	2,773
2013	12.6%	24,864	1,492	1,327
2014	6.3%	12,492	750	642
2015	3.8%	7,565	454	373
2016	2.6%	5,078	305	240
2017	1.5%	2,965	178	134
2018	0.5%	1,013	61	44
			32,751	31,510

Technical Provision = 1,092,543

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Questions?